

STUDENT LEARNING ASSESSMENT REPORT
ACADEMIC YEAR 2005-06
DEPARTMENT OF PHYSICS - UPRM
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SECTION I: Mission and Student Learning Outcomes

MISSION

The mission of the Department of Physics derives from the triple mission of the University of Puerto Rico: Teaching: To educate our students to better understand and explore physical phenomena, to apply critical thinking in posing, analyzing and solving problems, and to maintain high professional standards in pursuing their careers. Research: To sustain and advance research and scholarship in Physics and related disciplines. Service: To promote Physics as a discipline throughout the university, the local school system and the community at large.

Student Learning Outcomes

The Physics Department Curriculum aims to develop graduates with the following skills and values:

- Critical thinking and problem solving skills through the scientific method
- A professional who values independent study and being self-taught
- Identification of the physical variables relevant to a physics problem
- Mathematical proficiency
- Identify stages and component areas in breaking-up physical problems
- Mathematical formulation of basic aspects of the contributing factors to a physical problem
- Basic laboratory skills for a methodical and fundamental investigation of physical phenomena
- Good communication skills in Spanish and English
- Computer skills for a systematic and fundamental investigation of physical phenomena
- Awareness of contemporary issues in physics
- Awareness of professional ethics
- Team working skills
- Develop an appreciation for the Arts and Humanities

The Physics Department Curriculum aims to develop graduates conceptually and quantitatively proficient in the following areas:

- CLASSICAL MECHANICS
- ELECTROMAGNETISM
- WAVE PHENOMENA AND OPTICS
- THERMODYNAMICS AND STATISTICAL MECHANICS

- QUANTUM MECHANICS
- ATOMIC PHYSICS
- SPECIAL RELATIVITY
- LABORATORY METHODS

Some graduates of the Physics program may also have additional competence in one or more of the following areas: Electronics, Nuclear and Particle Physics, Condensed Matter, Meteorology, Astronomy, Laser Physics, Applied Optics, Mathematical Physics, Computational Physics.

SECTION II: SLA Results

Sub-section	Content
Focus of Assessment Project	<ul style="list-style-type: none"> • The project objective was to measure the effect of our curriculum in producing students that fulfill the proposed Physics Department graduating student profile.
Justification	<ul style="list-style-type: none"> • There was no previous assessment of how our curriculum was doing in developing skills and knowledge as defined in the department student learning outcomes.
Population	<ul style="list-style-type: none"> • A total of 35 students and 4 professors participated in the survey for curriculum assessment of skills and knowledge. • The intervention involved twelve students and one professor.
Assessment Cycle	<p><i>Pre-intervention</i></p> <ul style="list-style-type: none"> • A questionnaire having 41 questions (see Appendix A) asked our students their perception of the mastery of skills and knowledge they have developed in their curriculum. Results revealed a majority of students believe the curriculum is weak in Atomic Physics, Solid State, Nuclear Physics and Elementary Particles. <p><i>Intervention</i></p> <ul style="list-style-type: none"> • The Physics Undergraduate Seminar (PHYS 4002) was used to verify if the student perception regarding poor knowledge in the four core physics areas was correct. A pre-test having twenty multiple choice questions in the aforementioned areas was given the first day of classes. The average score in the test was 35. • The teaching strategy to improve student performance in the four weak areas included self study, individual discussions with professor, and oral presentations (seminars) of material by students. For the seminars, students were divided in six groups and required to make three or four presentations of basic topics in particle, atomic, solid state, superconductivity, nuclear, and fission/fusion physics.

	<ul style="list-style-type: none"> At the end of each major topic presentation (four in total), a post-test of 10 multiple questions was given to evaluate the new knowledge in that field.
Results	<ul style="list-style-type: none"> The average score in the pre-test was 35. The four post-tests results were combined and averaged over the twelve students, yielding a performance score of 94 for the whole group, which shows a dramatic improvement in the student's knowledge (see Appendix B, Figure 1)
Possible Reasons or Hypotheses	<ul style="list-style-type: none"> Although the fundamentals of Atomic Physics, Solid State, Nuclear Physics and Elementary Particles are covered in the General Physics textbook we presently use (as well as in others we have used in the past), covering those topics would require a third semester of General Physics, which we don't have in our curriculum. Moreover, we don't have intermediate courses in these areas, except Solid State, which is an elective.
Course of Action	<ul style="list-style-type: none"> A revision of the two/4 credits General Physics course for physics majors is presently underway. Probably it will be replaced by 3 courses of 3 credits each. The third of these courses would cover Modern Physics (which contains the four weak areas in our curriculum).
Appendices	<p>A. Curriculum Assessment Of Skills And Knowledge</p> <p>B. Intervention Results</p>

A. Curriculum Assessment of Skills and Knowledge



University of Puerto Rico
Mayagüez Campus
Department of Physics

CURRICULUM ASSESSMENT OF SKILLS and KNOWLEDGE*

1. Semester (today's date):
 - a. First (August-December) 2005-2006
 - b. Second (January-May) 2005-2006

2. Sex:
 - a. Male
 - b. Female

3. Physics Undergraduate program:
 - a. Theoretical Physics
 - b. Physical Science

4. Year of Study:
 - a. Freshman
 - b. Sophomore
 - c. Junior
 - d. Senior

5. Your motivation to study Physics was because of
 - a. influence of a high school Physics teacher
 - b. a presentation of UPRM Physics Department professors in high school
 - c. visit(s) to UPRM Physics Department Planetarium
 - d. visit to a UPRM Physics Department open house
 - e. d. other _____

6. You are in the Physics Department Undergraduate Program because you
 - a. wanted to become a physicist and entered this department
 - b. had the intention of transferring to an Engineering Program, but changed your mind
 - c. had the intention of transferring to an Engineering Program, but have not completed the requirements for the transfer
 - d. were in another Department, but became interested in Physics later on
 - e. other _____

* Adapted from SEED (Civil Engineering Department – UPR-RUM)

The results of this assessment will help the department plan and adjust the curriculum to meet the Physics Department graduating student profile. So your participation in this survey is very important.

PART I: Curriculum correlation to the Physics graduating student profile.

Directions:

Using the scale below, please evaluate your perception of the mastery of skills and knowledge you have developed in this curriculum. (The skills and content here presented are those approved by the Physics faculty as pertinent).

- A. None (no skills/no experience)
- B. Little (rudimentary skills/very little experience)
- C. Fair (average skills & experience developed)
- D. Good (above average skills and experience)
- E. Excellent (Advanced skills/extensive experience)

SKILL/VALUE (Student Profile)	ASSESSMENT
7. Critical thinking and problem solving	
8. Team work	
9. Oral and written communication skills	
10. Computer literacy and its application to Physics problem solving	
11. Laboratory tools and techniques	
12. Awareness of contemporary issues in Physics	
13. Mathematical proficiency	
14. Ability to learn by him/herself (lifelong learning)	
15. Leadership	
16. Ethics	

Please evaluate your knowledge in the following core areas:

- A: none B: little C: fair D: good E: excellent

CONTENT	ASSESSMENT
17. Classical Mechanics	
18. Electromagnetism	
19. Wave phenomena and Optics	
20. Thermodynamics and Statistical Mechanics	
21. Quantum Mechanics	
22. Atomic Physics	
23. Special Relativity	
24. Laboratory Methods	

Please evaluate your knowledge in the following specialized areas.

A: none B: little C: fair D: good E: excellent

CONTENT	ASSESSMENT
25. Nuclear and particle Physics	
26. Solid State Physics	
27. Meteorology	
28. Astronomy	
29. Laser Physics	
30. Applied Optics	
31. Computational Physics	

Evaluate strengths (A) and weakness (B) of our curriculum:

CRITERIA	STRENGTHS A	WEAKNESS B
32. Variety of courses		
33. Research Opportunities		
34. Faculty		
35. Flexibility in curriculum		
36. Communication skills development		
37. Math and statistics integration to Physics		
38. Equipment in the laboratories		

39. Suggestions for improving the curriculum for it to meet the graduating student profile:

40. Comments on the laboratories of our courses:

41. Other comments

B. Intervention Results

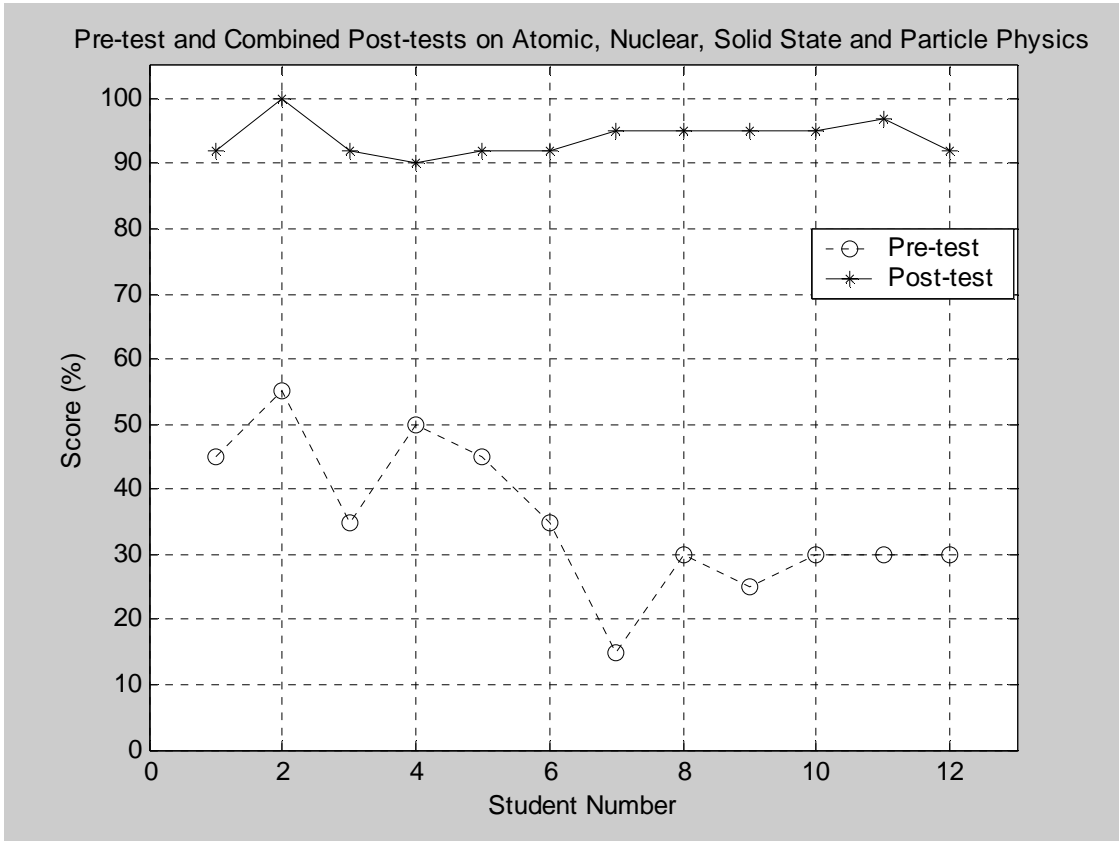


Figure 1. Pre-test and post-test performance of physics majors in intervention